

03301

LORAIN

Products Corporation

LORAIN

12B1

POWER UNIT

SPEC NO. 5776-001 SERIAL NO.

2394

instructions

INSTALLATION

OPERATION

MAINTENANCE

DESIGNERS AND MANUFACTURERS OF

power equipment without moving parts **SUB-CYCLE[®]** AND **FLOTROL[®]**
CONVERTERS RECTIFIERS

FOR PARTS OR SERVICE, Contact:

Lorain Products Corporation
Service Department
1122 "F" Street
Lorain, Ohio 44052
PH: (216) 288-9191
TWX: 810-426-2130

NOTE

PROGRAMMED PREVENTIVE MAINTENANCE Is Available On
This And Other Lorain Products Manufactured Equipment. For
Further Information, Contact "Service Manager" At The Above
Address.

LORAIN
12B1
POWER UNIT
SPEC NO. 5776-001 SERIAL NO. ²³⁹⁴

THIS FLOTROL IS ADJUSTED
TO 50.0 VOLTS. — VOLTS PER CELL
FOR A — CELL BATTERY. INPUT 117 VAC

OPTIONAL WIRING OR APPARATUS
FURNISHED:

A, B, E, G, H, J, K, M, N, Q, R, S, T, V, W, X,
Y, Z,

OTHER —

MODEL NO. 12B1 SERIAL NO. 2394

SD NO. 1421-01 ISS. NO. 14

DATE 2-5-71 PER DC

FOR PARTS OR SERVICE CONTACT

LORAIN PRODUCTS CORPORATION
SERVICE DEPARTMENT
1122 "F" STREET
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3172-412

INSTRUCTIONS
LORAIN MODEL 12B1 POWER UNIT
SD-1421-01

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INSTRUCTIONS
LORAIN MODEL 12B1 POWER UNIT
SD-1421-01

1. RATINGS

Input: 117 volt, 60 Hz, single-phase; 14.5 amperes maximum

Ringin Output: 105 volt, 20 Hz, with sumperimposed ringin tone; 7.5 watts

Tone Output: 600 Hz, modulated at 120 Hz; adjustable high and low level outputs, 25 milliwatt total

D-c Output: 46 to 52 volt, adjustable; 12 amperes continuous, 18 amperes intermittent

2. DESCRIPTION

LORAIN Type 12B1 Ringin, Tone, and D-c Supply furnishes ringin current with superimposed ringin tone, tone suitable for use as dial tone or busy signal, and filtered d-c which can either be used to charge a battery or can be supplied directly to load in a batteryless installation.

3. INSTALLATION

a. Mounting

LORAIN Type 12B1 Ringin, Tone, and D-c Supply is mounted on a base plate 23 by 22-1/4 inches; it has overall depth of 7-1/2 inches. Eight holes in the base plate will accept mounting screws up to 1/4 inch diameter.

b. Electrical Connections

A three wire input a-c cord and ground-type plug are furnished. To gain access to output terminals, remove the rear cover from the 12B1 Power Unit. Output terminals are located on a terminal strip at the upper left hand side as viewed from the rear:

50 volt d-c: BAT terminals + and -
20 Hz ringin: 20 ~ terminals R and RG
Low level tone: TONE terminals DT and DTG
High level tone: TONE terminals T and TG

3. b. (continued)

NOTE: If Model 12B1 Power Unit is used to charge a battery, disconnect a wire (designated SEE NOTE 104) which is connected between two terminals of a component card at lower left hand side, as viewed from rear of unit. This wire must be reconnected if unit is later used without a battery.

If an accessory Charge Failure Alarm Relay is furnished, this relay assembly can be connected to give an external alarm to show d-c output failure. Terminals 2 to 3 and terminals 5 to 6 of relay assembly each supply a closed-loop circuit to give an alarm, while closed-loop circuits between terminals 1 to 2 and terminals 4 to 5 are broken, to give a similar open-circuit actuated alarm. If Charge Failure Alarm Relay must operate another relay which requires current greater than 0.100 ampere, or supply current in excess of 0.250 ampere to resistive load, connect a 0.5 microfarad capacitor and a 100 ohm 5 watt resistor in series across terminals of relay assembly as contact protection. Contact rating is 1.0 ampere when connected in a 50 volt d-c circuit.

c. Adjustment

Input a-c voltage range, output d-c voltage, dial tone level, and busy tone level are adjustable as described in paragraph 4 b, c, and d, below. If the d-c output is connected to charge a battery, refer also to the overload cutoff adjustment described in paragraph 4 f, below.

4. ADJUSTMENT

a. General

D-c output voltage of this LORAIN Power Supply is adjusted by means of potentiometer R6 on its front panel. To gain access to the input a-c voltage range, dial tone level, busy tone level, and overload cutoff adjustments, remove the rear cover from the 12B1 Power Supply.

b. Input A-c Voltage Range

This adjustment is made by connection of adjustment lead E to taps of the power transformer T1. It adapts characteristics of the d-c supply to prevailing a-c service voltages.

- (1) If possible, determine range over which a-c service voltage varies. One of three input a-c voltage ranges will usually be most suitable for prevailing a-c voltages.

4. b. (2) Make input voltage range connection as necessary:

105 to 117 volts, tap 111
 111 to 123 volts, tap 117
 117 to 129 volts, tap 123

c. D-c Output Voltage

Potentiometer R6 adjusts d-c output voltage between 46 and 52 volts. To increase d-c output voltage, turn R6 adjustment shaft clockwise.

d. High-Level Tone Output

High-level tone output is adjusted by connection of a blue lead and a white-red-blue lead at a pair of terminals 5 through 8, on a terminal block at upper left hand side of Power Unit, as viewed from rear, immediately below output terminals. Terminal connections give tone levels as follows:

<u>Tone Voltage</u>	<u>Terminals</u>
1.64	5, 6
3.29	6, 7
4.93	5, 7
6.57	7, 8
9.86	6, 8
11.50	5, 8

e. Low-Level Tone Output

Low-level tone output is adjustable, separately and independently of high-level tone output, by connection of an orange lead and a green lead at a pair of terminals 1 through 4 on tone level adjustment terminal block described above. Terminal combinations give tone levels as follows:

<u>Tone Voltage</u>	<u>Terminals</u>
0.33	1, 2
0.66	2, 3
0.99	1, 3
1.31	3, 4
1.97	2, 4
2.30	1, 4

f. Overload Cutoff

As adjusted at the factory, an overload cutoff circuit limits d-c output to 18 amperes. This is an intermittent service rating; continuous service rating is 12 amperes. Overload current limit is adjusted by potentiometer R8. If d-c output is connected to charge a battery, R8 should be reset to limit d-c output to 12 amperes.

4. g. Factory Adjustments

Special adjustments are made at the factory on each LORAIN Model 12B1 Power Supply. It is recommended that no change be made in these adjustments:

- (1) Resistor R7 is set to determine range over which potentiometer R6 will adjust d-c output voltage.
- (2) Setting of resistor R102 adjusts frequency of 120 Hz component in dial and busy tone.
- (3) Tap connections to primary windings of tone output transformer T102 determine frequency of 600 Hz component in dial and busy tone.

5. OPERATION

a. Starting and Stopping

To turn all power circuits of Power Supply on or off, throw the toggle switch to ON or OFF position.

b. Metering

A voltmeter indicates output voltage of D-c Supply at all times.

c. Fuses

Fuse F1 protects a-c input of this LORAIN Power Supply. Fuse F3 protects d-c output. Fuse F4 protects d-c supply to the Ringing Generator and Tone Generator circuits. Fuses F5 and F6 protect power transformer T1 in the event diodes CR5 or CR6 become shorted. Fuse F101 is in series with d-c input to Type 4871-311 Tone Generator; it is located on Tone Generator chassis. If necessary to replace any of these fuses, replace only with the following Bussmann fuse types and sizes, or equivalent:

Fuse F1: Type BAF, 15 ampere

Fuse F3: Type BAF, 20 ampere

Fuse F4: Type MDL, 1 ampere

Fuse F5: Type AGC, 1 ampere

Fuse F6: Type AGC, 1 ampere

Fuse F101: Type AGC, 1/2 ampere

6. D-C SUPPLY CIRCUIT DESCRIPTION

a. Input Circuit

Input a-c is supplied through power switch SW1, fuse F1, end leg windings of transductor L1, and rectifier CR1 to primary windings of power transformer T1.

Note that during some a-c half-cycles, current flows through SW1, F1, L1 end leg windings between terminals 2 and 1, one-half of CR1, and T1 primary windings. On alternate a-c half-cycles, current flows through T1 primary windings (direction reversed), the remaining half of CR1, L1 end leg windings between terminals 6 and 5, F1, and SW1. In this way, CR1 causes d-c to flow in alternate L1 end leg windings while allowing a-c to flow in T1 primary windings.

b. D-c Power Circuit

Alternating current in power transformer T1 primary windings induces alternating current in T1 secondary windings. One T1 secondary furnishes a-c to a center-tap rectifier made up of diodes CR5 and CR6. This rectifier supplies d-c to operate relay K. T1 power secondary furnishes a-c through primary windings of current transformer T2 to full-wave bridge power rectifier CR2, which supplies d-c to load.

In event of a-c power failure, relay K releases to disconnect output from load. In event a battery was being charged, this prevents battery discharge through bleeder resistor R4.

Chokes L2 and L3, with capacitors C3 and C4, form an output filter which removes a-c ripple from CR2 output to smooth it and make D-c Supply output pure d-c. Resistance-capacitance network C2-R3 protects CR2 from voltage spikes generated in the output filter.

c. Transductor L1

Transductor L1 is the circuit element which regulates D-c Supply output voltage.

As described in a, above, direct current flows through alternate L1 end leg windings on alternate a-c half-cycles. End leg winding flux is sufficient to saturate the L1 core for a portion of each half-cycle.

So long as the L1 core is not saturated, a voltage is developed across whichever end leg winding is carrying current; however, when its core becomes saturated, essentially no voltage is developed across this winding. Since, as described in a, above, each L1 end leg winding is connected in series with primary windings of power transformer T1, T1 primary voltage increases whenever the L1 core is saturated.

6. c. (continued)

Transducer L1 has a control winding on its center leg. Direct current flows through this winding in a direction to oppose saturation of the L1 core, so that any increase in control current will reduce portion of each a-c half-cycle during which the core is saturated. This reduces effective T1 primary voltage. Conversely, a decrease in control current increases portion of each a-c half-cycle during which the core is saturated to increase effective T1 primary voltage. In this way, L1 regulates D-c Supply output voltage by varying T1 primary voltage.

Note also that L1 end leg winding current increases as D-c Supply output current increases. This acts to increase portion of each a-c half-cycle during which the L1 core is saturated, and increase T1 primary voltage, as output current increases. Since resistive voltage drops tend to decrease output voltage as output current increases, this property of L1 aids in maintaining constant output voltage despite output current variations.

d. Output Voltage Control Circuit

Resistor R14 and transducer L1 control windings between terminals 4 and 3 are connected across D-c Supply output so that current flows from positive output through R14, and L1 windings between terminals 4 to 3 to negative output. This current acts as bias to oppose L1 core saturation.

In addition to furnishing d-c to operate relay K (see b, above), diodes CR5 and CR6 also furnish d-c collector supply through choke L4 to transistors Q1 and Q2. Choke L4 and capacitor C10 form an output filter for this collector supply circuit.

Resistances R5, R6, and R7 are also connected in series across D-c Supply output. A voltage developed across portions of R6 and R7 is applied through diode CR9 to the Q1 base. Current then flows from positive output through zener diode CR10, Q1 emitter and base, CR9, a portion of R6, and R5 to negative output. This drives Q1 to conduction. It causes current to flow from positive CR5-CR6 output through L1 control windings between terminals 4 and 3, CR10, Q1 emitter and collector, and resistors R12 and R11 to negative CR5-CR6 output.

Since voltage developed across CR10, Q1, and R12 exceeds voltage developed across resistor R14, this drives transistor Q2 to conduction. Current then flows from positive CR5-CR6 output through L1 control windings between terminals 3 and 4, diode CR7, and Q2 emitter and collector to negative CR5-CR6 output. Since this current flows through L1 control windings from terminals 3 to terminal 4, it is subtracted from R14 bias current to aid L1 core saturation. Diode CR7 protects Q2 from any inverse voltage spikes which might be generated in L1 control windings or choke L5.

6. d. (continued)

Note that zener diode CR10 conducts in the reverse direction. Its characteristics are such that, once this occurs, an essentially constant voltage appears across CR10. This voltage holds Q1 emitter potential constant so that any increase in voltage developed across portions of R6 and R7 (through increase in D-c Supply output voltage) will drive Q1 to greater conduction.

When Q1 is driven to greater conduction, voltage developed across CR10, Q1 emitter and collector, and R12 is reduced. This reduces drive to Q2, reduces Q2 collector current through L1 control windings, and hence allows R14 bias current to oppose L1 core saturation to a greater extent, as necessary to reduce D-c Supply output voltage.

e. Overload Cutoff Circuit

As mentioned in b, above, primary windings of current transformer T2 are connected in series between secondary windings of power transformer T1 and power rectifier CR2. Capacitor C9 furnishes an essentially constant preload at T2 secondary windings so that T2 secondary voltage is proportional to D-c Supply output current. A portion of T2 secondary windings furnishes a-c to a center-tap rectifier made up of diodes CR3 and CR4 so that rectifier d-c output voltage is also proportional to D-c Supply output current. Filter choke L5 supplies d-c from this rectifier across series resistances R8 and R9.

Resistor R8 is adjusted so that voltage developed across R9 and a portion of R8 will not exceed voltage developed across parts of resistances R6 and R7 so long as D-c Supply output current does not exceed a given value. Diode CR8 blocks current at this time.

As D-c Supply output current increases, however, R8-R9 voltage increases until it exceeds R6-R7 voltage. At this time, current flows from positive CR3-CR4 output through CR10, Q1 emitter and base, CR8, part of R8, and L5 to negative CR3-CR4 output. Diode CR9 blocks current at this time. Overload cutoff current, in turn, drives both Q1 and Q2 to greater conduction, and increases transducer L1 control current as necessary to decrease L1 core saturation and reduce D-c Supply output voltage. In this way, output current is limited to a safe value.

7. TONE GENERATOR CIRCUIT DESCRIPTION

One hundred twenty cycle pulse current is generated by a blocking oscillator, composed of transistor Q101, blocking oscillator transformer T101, capacitor C101, and diodes CR101 and CR102. Diode CR101 clamps Q101 collector voltage to negative collector supply voltage and prevents damage to Q101 through voltage spikes generated in T101 primary windings. Resistor R103 supplies negative base bias to Q101.

7. (continued)

Initially, Q101 base current flows from positive ground through Q101 emitter and base, CR102, T101 secondary windings between terminals 2 and 1, R101, and R102 to negative collector supply. This drives Q101 to conduction so that current flows from positive ground through Q101 emitter and collector, and T101 primary windings between terminals 3 and 4 to negative collector supply. Secondary windings of T101 are connected to supply positive potential at R101 end of C101 when primary current flows. Primary current induces secondary current which quickly charges C101 until capacitor charge potential prevents further flow of Q101 base current and cuts off Q101. At this time, CR102 prevents capacitor discharge through R103 so that C101 must discharge through R101 and R102 to negative collector supply before Q101 base current can flow again to drive Q101 to conduction. Repetition rate of this cycle is determined by discharge time constant of C101 through R101 and R102. Resistor R102 adjusts oscillator frequency.

Momentary instants of conduction in Q101 each cause a ground pulse to appear across a series circuit of capacitor C102 and primary windings of output transformer T102. Tap connections to these windings adjust resonant frequency of this circuit to 600 Hz. Thus, these ground pulses excite the resonant circuit to damped 600 Hz oscillation, with 120 Hz cycle pulse exciting frequency superimposed.

LORAIN PRODUCTS CORPORATION
Lorain, Ohio, U. S. A.

LORAIN PRODUCTS (CANADA) LTD.
St. Thomas, Ontario, Canada

June 18, 1970

ELECTRICAL PARTS LIST
LORAIN MODEL 12B1 POWER UNIT
SPEC. NO. 5776-001

The quantity of spare parts (except fuses) listed should be sufficient for ten or less 12B1 POWER UNITS for at least 18 months. When ordering parts, please furnish equipment Model No., Spec. No., and Serial No. as given on the equipment nameplate.

<u>Ref.</u> <u>Desiq.</u>	<u>LPC</u> <u>Part No.</u>	<u>Description</u>	<u>Quantity</u> <u>Recm. Spares</u>
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ASSEMBLIES

	4871-311	Tone Generator Sub-Assembly	**
	4871-030	Ringing Generator	**

CAPACITORS

C1	2715-145	5.0UF 150V	1
C2	2713-456	.25UF 600V	1
C3	2731-324	8500UF 75V, Electrolytic	1
C4	2731-324	8500UF 75V, Electrolytic	*
C9	2714-541	1.5UF 230VAC	1
C10	2731-147	100UF 25V, Electrolytic	1
C11	2731-250	1800UF 60V, Electrolytic	1

DIODES

CR3	2812-225	1N1221 Silicon	1
CR4	2812-225	1N1221 Silicon	*
CR5	2812-215	1N1218 Silicon	2
CR6	2812-215	1N1218 Silicon	*
CR7	2812-215	1N1218 Silicon	*
CR8	2812-121	1N537 Silicon	1
CR9	2812-121	1N537 Silicon	*
CR10	2835-326	6.2V, Zener	1

FUSES

F1	2483-434	15A, Cartridge	3
F3	2483-438	20A, Cartridge	3
F4	2484-225	1A, Cartridge	3
F5	2483-222	1A, AGC	3
F6	2483-222	1A, AGC	*

*This part appears more than once in this list.
Use recommended spare quantity stated where part first appears in this list.

**For Recommended Spares, refer to Electrical Parts List for this assembly.

ELECTRICAL PARTS LIST
LORAIN MODEL 12B1 POWER UNIT
SPEC. NO. 5776-001

<u>Rec. Desig.</u>	<u>LPC Part No.</u>	<u>Description</u>	<u>Quantity Recm. Spares</u>
<u>INDUCTORS</u>			
L1	4531-505	Transductor	-
L2	4421-503	Choke Swinging	-
L3	4416-502	Filter Choke	-
L4	4425-024	Filter Choke Reference	-
L5	4426-503	Filter Choke	-
<u>METERS</u>			
V	2943-211	0-80V DC, Voltmeter	-
<u>RECTIFIERS</u>			
CR1	2821-132	Voltage Doubler	1
CR2	2822-042	Power	1
<u>RELAYS</u>			
K	2561-010	12V, 1A Power	1
<u>RESISTORS</u>			
R1	2662-839	100 Ohm 2W, Fixed	1
R2	2662-823	22 Ohm 2W, Fixed	1
R3	2662-437	82 Ohm 2W, Fixed	1
R4	2656-709	75 Ohm 100W, Fixed	1
R5	2651-732	750 Ohm 5W, Fixed	1
R6	2683-228	25 Ohm 2W, Variable	1
R7	2681-414	200 Ohm 10W, Adjustable	1
R8	2683-632	40 Ohm 4W, Variable	1
R9	2662-432	51 Ohm 2W, Fixed	1
R10	2651-350	7K Ohm 3W, Fixed	1
R11	2651-735	1K Ohm 5W, Fixed	1
R12	2651-329	500 Ohm 3W, Fixed	1
R13	2615-267	1.5K Ohm 1/2W	1
R14	2652-327	400 Ohm 10W, Fixed	1
<u>SWITCHES</u>			
SW1	2513-126	Toggle SPST	1
<u>TRANSFORMERS</u>			
T1	4461-501	Power	-
T2	4443-304		-

ELECTRICAL PARTS LIST
LORAIN MODEL 12B1 POWER UNIT
SPEC. NO. 5776-001

<u>Ref.</u> <u>Desig.</u>	<u>LPC</u> <u>Part No.</u>	<u>Description</u>	<u>Quantity</u> <u>Recm. Spares</u>
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TRANSISTORS

Q1	2848-071	2N3618	1
Q2	2848-071	2N3618	*

MISCELLANEOUS

2488-106	Fuseholder	1
2488-141	Fuseholder	1
2488-206	Fuseholder	1

LORAIN PRODUCTS CORP.
Lorain, Ohio
July 13, 1970

Printed in U.S.A.

lhs

ELECTRICAL PARTS LIST
LORAIN 4871-311 TONE GENERATOR SUB-ASSEMBLY

The quantity of spare parts (except fuses) listed should be sufficient for ten or less 4871-311 TONE GENERATOR SUB-ASSEMBLIES for at least 18 months.

<u>Ref.</u> <u>Desiq.</u>	<u>LPC</u> <u>Part No.</u>	<u>Description</u>	<u>Quantity</u> <u>Rec. Spares</u>
<u>CAPACITORS</u>			
C101	2714-541	1.5UF 230VAC	1
C102	2713-339	0.47UF 400VDC	1
<u>DIODES</u>			
CR101	2812-310	1N4818 Silicon	1
CR102	2812-310	1N4818 Silicon	*
<u>FUSES</u>			
F101	2483-215	.50A, Cartridge	1
<u>RESISTORS</u>			
R101	2651-744	3K Ohm 5W, Fixed	1
R102	2683-268	2.5K Ohm 2W, Variable	1
R103	2662-839	100 Ohm 2W, Fixed	1
R104	2614-294	20K Ohm .5W, Fixed	1
R105	2614-224	24 Ohm, Fixed	1
<u>TRANSFORMERS</u>			
T101	4437-502	Oscillator Blocking	-
T102	4468-004	Output	-
<u>TRANSISTORS</u>			
Q101	2848-060	2N1537	1
<u>MISCELLANEOUS</u>			
	2488-109	Fuseholder	1

*This part appears more than once in this list.
Use recommended spare quantity stated where part first appears in this list.

LORAIN PRODUCTS CORP.
Lorain, Ohio
March 9, 1970

ELECTRICAL PARTS LIST
LORAIN 4871-030 RINGING GENERATOR ASSEMBLY

The quantity of spare parts (except fuses) listed should be sufficient for ten or less RINGING GENERATOR ASSEMBLIES for at least 18 months.

<u>Ref.</u> <u>Desig.</u>	<u>LPC</u> <u>Part No.</u>	<u>Description</u>	<u>Quantity</u> <u>Recm. Spares</u>
<u>ASSEMBLIES</u>			
A1	4336-026	Component Mounting	1
<u>CAPACITORS</u>			
C1	2731-208	800UF 75V, Electrolytic	1
C2	2714-547	3UF 230VAC	1
<u>INDUCTORS</u>			
L1	4424-014	Choke	-
<u>TRANSFORMERS</u>			
T1	4464-502	Non-linear Power	-

LORAIN PRODUCTS CORP.
Lorain, Ohio
July 10, 1970

Printed in U.S.A.

lhs

TO FIG. 3 W-BK 10

TO FIG. 1 BK 9

W-R-B 8

7

B 6

5

G 4

3

2

0 1

TO FIG. 4

TONE SUPPLY
600/120 HZ 25 MW
(4871-311)
SD-981-03

FROM FIG. 2 { W-BK 1

FROM FIG. 1 { B 2

BK 3

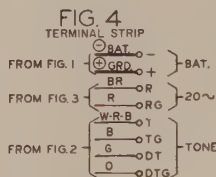
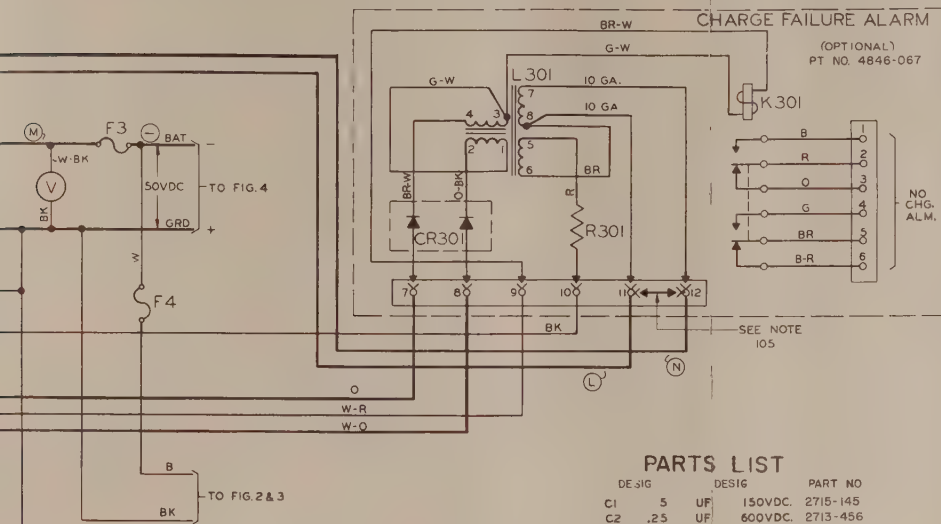
TO FIG. 4 { BR 4

R 5

RINGING SUPPLY
20HZ 7.5 WATTS
(4871-030)

101. VOLTAGE MEASUREMENTS SHOULD BE WITHIN $\pm 5\%$ OF VALUES SHOWN WITH NOMINAL VOLTAGE APPLIED AND NO DC LOAD. THE VALUES SHOWN ARE AS MEASURED WITH A METER HAVING A SENSITIVITY OF 5000 OHMS/VOLT ON AC RANGES, 20000 OHMS/VOLT ON DC RANGES.
102. AT NOMINAL INPUT & 12 AMP LOAD, THE DC VOLTAGE BETWEEN THESE POINTS SHOULD BE GREATER THAN 7 VOLTS.
103. THE VOLTAGE DROP ACROSS R13 SHOULD BE APPROXIMATELY 0.1 VOLTS GREATER THAN THE VOLTAGE MEASURED ACROSS CR10.
104. WHEN OPERATED WITH BATTERY REMOVE STRAP.
105. WHEN CHARGE FAILURE ALARM IS ADDED, REMOVE JUMPER BETWEEN TERMINALS 11 & 12.

MODEL NO.	TONE SUPPLY (SEE FIG. 2)	RINGING SUPPLY (SEE FIG. 3)	SPEC. NO.
12B1	REQ'D	REQ'D	5776-001
12B4	NOT REQ'D	NOT REQ'D	5776-004



PARTS LIST

DESIG	DESIG	PART NO
C1	5 UF	150VDC. 2715-145
C2	.25 UF	600VDC. 2713-456
C11(2)	1000 UF	60VDC. 2731-250
C9	1.5 UF	230VAC. 2714-541
C10	100 UF	25VDC. 2731-147
C34	8500 UF	75VDC. 2731-324

CR1	2821-132
CR2	2822-042
CR3, CR4	2612-225
CR5, CR6, CR7	2812-213
CR8, CR9	2812-121
CR10	2835-326
CR301	335W

F1	15AMP BAF	2483-434
F3	20AMP BAF	2483-438
F4	1 AMP MDL	2484-225
F5, F6	1 AMP AGC.	2483-222
K	RELAY	2561-010
K301		4265-008

L1	4531-505
L2	4421-503
L3	4416-502
L4	4425-024
L5	4426-503

Q1, Q2	2848-071
--------	----------

R1	100 OHM	1 WATT	165Y
R2	22 OHM	1 WATT	2662-823
R3	82 OHM	2 WATT	2662-437
R4	75 OHM	100 WATT	2656-709
R5	750 OHM	5 WATT	2651-732
R6	25 OHM	2 WATT POT	2693-228
R7	200 OHM	10 WATT ADJ.	2691-414
R8	40 OHM	4 WATT POT	2693-632
R9	50 OHM	1 WATT	2662-432
R10	7000 OHM	3 WATT	2651-350
R11	1000 OHM	5 WATT	2651-735
R12	500 OHM	3 WATT	2651-329
R13	1500 OHM	1/2 WATT	2615-267
R14	400 OHM	10 WATT	2652-327

R301	500 OHM	10 WATT	2652-329
T1	4461-501		
T2	4443-304		

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REV	CHANGE	DATE	REVISION
1	6381 RW	10	PHOTO. REPRO.
2	10-27-64	24	N.C.A. ADD'D
3	CR8,9	3	WERE 1,191 IWG
4	Q1 & 2 W.C.R.E	52	2N457, N.C.A.
5	CHG'D TO CFA	52	524AS & 525AS
6	REMOVED.		
7	8373 WB	10	T1-T4 INTERCHG'D
8	12709	10	R3 WAS 254V
9	13928	25	WIRE COLO.
10	14304	4-16-65	C3 AND C4 WERE
11	14881	12-3-65	C3-6 AND C7-8
12	1646D	5-21-66	CAP. OF C11 CHG'D
13	18593	10-30-68	P.T. NO. GH6D
14	19170	4-29-69	F4 WAS AGC.
15	18898	5-12-69	C11 DESIG
16	18420	G	Q1 AND Q2 WERE
17	20103	1	RINGING GENERATOR
18	20247	5	FUSES F5 AND F6
19	20247	5	FUSES F5 AND F6
20	20247	5	FUSES F5 AND F6
21	20247	5	FUSES F5 AND F6
22	20247	5	FUSES F5 AND F6
23	20247	5	FUSES F5 AND F6
24	20247	5	FUSES F5 AND F6
25	20247	5	FUSES F5 AND F6
26	20247	5	FUSES F5 AND F6
27	20247	5	FUSES F5 AND F6
28	20247	5	FUSES F5 AND F6
29	20247	5	FUSES F5 AND F6
30	20247	5	FUSES F5 AND F6
31	20247	5	FUSES F5 AND F6
32	20247	5	FUSES F5 AND F6
33	20247	5	FUSES F5 AND F6
34	20247	5	FUSES F5 AND F6
35	20247	5	FUSES F5 AND F6
36	20247	5	FUSES F5 AND F6
37	20247	5	FUSES F5 AND F6
38	20247	5	FUSES F5 AND F6
39	20247	5	FUSES F5 AND F6
40	20247	5	FUSES F5 AND F6
41	20247	5	FUSES F5 AND F6
42	20247	5	FUSES F5 AND F6
43	20247	5	FUSES F5 AND F6
44	20247	5	FUSES F5 AND F6
45	20247	5	FUSES F5 AND F6
46	20247	5	FUSES F5 AND F6
47	20247	5	FUSES F5 AND F6
48	20247	5	FUSES F5 AND F6
49	20247	5	FUSES F5 AND F6
50	20247	5	FUSES F5 AND F6
51	20247	5	FUSES F5 AND F6
52	20247	5	FUSES F5 AND F6
53	20247	5	FUSES F5 AND F6
54	20247	5	FUSES F5 AND F6
55	20247	5	FUSES F5 AND F6
56	20247	5	FUSES F5 AND F6
57	20247	5	FUSES F5 AND F6
58	20247	5	FUSES F5 AND F6
59	20247	5	FUSES F5 AND F6
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61	20247	5	FUSES F5 AND F6
62	20247	5	FUSES F5 AND F6
63	20247	5	FUSES F5 AND F6
64	20247	5	FUSES F5 AND F6
65	20247	5	FUSES F5 AND F6
66	20247	5	FUSES F5 AND F6
67	20247	5	FUSES F5 AND F6
68	20247	5	FUSES F5 AND F6
69	20247	5	FUSES F5 AND F6
70	20247	5	FUSES F5 AND F6
71	20247	5	FUSES F5 AND F6
72	20247	5	FUSES F5 AND F6
73	20247	5	FUSES F5 AND F6
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77	20247	5	FUSES F5 AND F6
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82	20247	5	FUSES F5 AND F6
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96	20247	5	FUSES F5 AND F6
97	20247	5	FUSES F5 AND F6
98	20247	5	FUSES F5 AND F6
99	20247	5	FUSES F5 AND F6
100	20247	5	FUSES F5 AND F6

SCHEMATIC DIAGRAM FOR 12B SERIES POWER UNITS

LORAIN Products Corporation
LORAIN, OHIO

REV	DATE	BY	CHKD	APP'D
1	10-24-64	RW		
2	10-24-64	RD		
3	10-24-64			
4	10-24-64			
5	10-24-64			
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99	10-24-64			
100	10-24-64			

SD-1421-01

CIRCUIT DESCRIPTION
RINGING GENERATOR ASSEMBLY 4871-030
SD4871-030

1. GENERATOR

a. Ratings

Ring output: 85 to 100 volts, 20 Hz at 7.5 watts

D-c output: 50VDC filtered

2. CIRCUIT DESCRIPTION

a. Input Circuit

Choke L1 and capacitor C1 form an input filter which prevents noise from being fed back from the ringing generator to the power supply.

b. Oscillator

Transistors Q1 and Q2, saturable transformer T1, diodes CR1 and CR2, resistors R1-R5 and capacitors C1 and C2 form the oscillator circuit.

When battery is first applied at the input terminals, starting current flows from ground through R5 and T1 windings 3, 4 and 5 to the base of transistors Q1 and Q2. Starting oscillation of the circuit depends on the gain difference existing between the apparent identical circuits of transistors Q1 and Q2. Assume transistor Q2 conducts and begins the oscillator cycle. Current then flows from (+) battery through saturable transformer T1 windings 7 and 8 through Q2 collector and emitter to (-) battery.

T1 current induces voltage in T1 windings 3, 4 and 5. The latter windings apply negative voltage to the base of Q1 and positive to the base of Q2, driving Q2 to greater conduction and driving Q1 to cutoff.

Once Q2 and T1 current starts to flow, it increases rapidly until the T1 core becomes saturated. At this time, Q2 limits the current. A voltage is developed across the Q2 emitter and collector which causes decay of T1 primary current and reverses polarity of windings 3, 4 and 5 voltages. The windings now drive Q2 to cutoff and drive Q1 to conduction.

When Q1 conducts, current flows from (+) battery through the Q1 collector and emitter, the other half of the T1 windings 7 and 6 to (-) battery. Note that current direction has now reversed with respect to the T1 windings 6, 8 and 3, 5. Once started, Q1 and T1 current increases rapidly, increasing winding 4 to 5 drive voltage, until the T1 core again becomes saturated.

2. b. (continued)

Q1 then limits the current. T1 current again decays, again reversing polarity of the windings 6, 8, 3 and 5 voltages.

The above cycle is repeated 20 times per second. The oscillator frequency is a function of the applied voltage, core of and turns of saturable transformer T1. Alternating T1 current induces square wave voltages in the T1 windings 1 and 2. C2 connected across T1 windings 1 and 2, reduces the amount of high frequency components (noise filter) of voltage to a level desired for ringback tone.

c. Output Circuit

The output circuit consists of saturable transformer T1 windings terminals 1 and 2 and capacitor C2.

The saturable transformer T1 windings terminals 1 and 2 provide a 20 Hz square wave and capacitor C2 filters noise from the square wave.

LORAIN PRODUCTS CORPORATION
Lorain, Ohio, U. S. A.

LORAIN PRODUCTS (CANADA) LTD.
St. Thomas, Ontario, Canada

May 19, 1970

A

B

C

D

E

F

G

H

FILTERED - 50 VDC OUTPUT

-50 VDC INPUT

GRD

AI

TBI(PART)

TBI(PART)

RINGING OUTPUT

L1

C1

+

BL

BL

Q1

Q2

R1

R3

CR1

CR2

R5

R2

R4

C2

MANUFACTURING NOTES:

- I. ALL WIRES TO BE 20 GA.
STRANDED UNLESS OTHERWISE
SPECIFIED.

ENGINEERING NOTES:

51. AS TERMINAL TO TERMINAL CONNECTIONS,
WIRE SIZES AND COLORS, AND PT. NO. ARE
SHOWN ON THIS SCHEMATIC, THERE IS NO
SEPARATE WIRING DIAGRAM DRAWING.
52. UNLESS OTHERWISE SPECIFIED,
RESISTANCE VALUES ARE IN OHMS,
CAPACITANCE VALUES ARE IN MICROFARADS.
53. HIGHEST REF. DESIGNATION USED ON THIS DRAWING.

RES.	CAP.
—	C2
NOT	USED
—	—

HIGHEST REF. DESIGNATION USED ON AI CIRCUIT CARD.

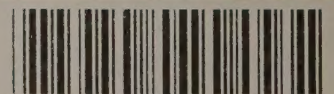
RES.	CAP.
R5	C2
NOT	USED
—	—

LIST OF MATERIAL			
DESIG.	QTY.	LPC. PT. NO.	DESCRIPTION
AI	1	4336-026	COMPONENT ASSY.
CI	1	2731-208	800 UF 75 VDC
C2	1	2714-547	3UF 230 VAC
LI	1	4424-014	INDUCTOR
TI	1	4464-502	POWER TRANSFORMER

REVISIONS			
ISS. NO.	CHGD. BY	DATE	DESCRIPTION
1	PM	NEW	
2	20141	6-19-70	C2 WAS 2714-547 R5 WAS 22K <i>G. Reson</i> <i>Ch. Miska</i> 6-24-70 <i>P.W. Hornell</i> 6-24-70

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SCHEMATIC DIAGRAM FOR ASSEMBLY 7.5 WATT 20 CYCLE RINGING GENERATOR		ISSUE	2
		DESIGN ENGR	N. KAMMILLER
		DRAWN BY	<i>John J. Hornell</i>
		CHECKED BY	<i>H. Miska</i>
LORAIN PRODUCTS CORPORATION LORAIN, OHIO LORAIN PRODUCTS (CANADA) LTD., ST. THOMAS, ONTARIO		DATE	9-25-69
		CHECKED BY	<i>H. Miska</i>
		APPROVED BY	<i>P.W. Hornell</i>
		RATING	
DWG SIZE		SD 4871-030	
SHEET 1 OF 1		PRINTED IN U.S.A.	



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